FINAL ACQUISITION REPORT

For the

2D MARINE SEISMIC SURVEY

Conducted by

NEXUS ENERGY Ltd.

In The Exploration Licence Area

VIC/P39

SURVEY START DATE 09TH FEBRUARY 2005

SURVEY COMPLETION DATE 12TH FEBRUARY 2005

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ENQUEST PTY. LTD.

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1 INTRODUCTION 2
1.1 OBJECTIVES 2
1.2 SURVEY PARAMETRES 2
1.3 ACQUISITION PARAMETERS 3
1.4 LOCATION MAP 4
1.5 LINE CO-ORDINATES 5
1.6 PROGRAM MAP 6

2 SYNOPSIS 7
2.1 OVERVIEW 7
2.2 SURVEY PRODUCTION BY LINE 8
2.3 STATISTICAL SUMMARY 9
2.4 TECHNICAL SUMMARY 10
2.5 VESSEL 12
2.6 SAFETY SUMMARY 15
2.7 RECOMMENDATIONS & CONCLUSION 17

3 NAVIGATION 18
3.1 NAVIGATION HARDWARE AND SOFTWARE 18
3.2 SURVEY POSITIONING METHOD USED 18
3.3 SURFACE POSITIONING 19
3.4 INTEGRATED NAVIGATION SYSTEM 21

4 ENVIRONMENT 22
4.1 WEATHER 22
4.2 TIDES, CURRENT AND FEATHER 22
4.3 NAVIGATION HAZARDS 22
4.4 ENVIRONMENTAL 22
4.5 CETACEAN REPORTING 23
4.6 FISHING 23
4.7 CORAL REEFS 23
4.8 CONCLUSION 23

5 INSTRUMENT TESTS 24

6 DIARY 26

7 MEASUREMENTS 28
7.1 GPS ANTENNA POSITION 28
7.2 OFFSET DIAGRAM & TOWING DIMENSIONS 29
7.3 TOWING SYSTEM 29

8 APPENDICES 30
8.1 MGC CONVENTIONS AND TERMINOLOGY 30
8.2 LINE AND SHOT POINT NUMBER CONVENTION 30
8.3 DESCRIPTION OF LINE LOG CONTENTS 31
8.4 ECHOSOUNDER CALIBRATION JANUARY 31ST 32
8.5 Associated Files on cd rom 33

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1 INTRODUCTION

1.1 OBJECTIVES

To carry out a High Quality 2D seismic survey of some 251 full fold kilometres over the VIC/P39 Block. The location is in the Bass Strait Oil Fields area south east of Lakes Entrance on the Victorian Coast. The survey being acquired on behalf of NEXUS ENERGY Ltd.

The seismic survey vessel was the Pacific Titan owned and operated by Swire Pacific Offshore Operations (Pte) Ltd who provided the marine crew. The vessel was on lease by Multiwave Geophysical Company ASA, who supplied the seismic personnel, data processing and logistics.

1.2 SURVEY PARAMETRES

The following is a summary of the survey parameters:

Survey type	: 2D
Client	: NEXUS ENERGY Ltd.
Survey name	: GNX05 2D MSS
SP int	: 18.75
Source	: 3040 in³. Sleeve guns
Streamer Length	: 3000 metres
Groups	: 240
Fold	: 90
Positioning	
Primary	: Fugro Starfix MRDGPS SPOT & Duel Frequency
Secondary	: Fugro Starfix MN8 dGPS
Water depth	: 40m TO 150m
Number of lines	: 15
Survey surface area	: na
Full fold sail line km	: 251.06
Port of supply	: Hobart, Tasmania
Contractor	: Multiwave Geophysical Company ASA
Vessel	: Pacific Titan
Client representation	: Enquest Pty. Limited

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1.3 ACQUISITION PARAMETERS

Recording System	: Sercel SEAL system rev. 4.0
Number of Channels	: 240
Record Length	: 6000ms
Sample Interval	: 2ms
Low Cut Filter	: 3Hz at 6 db/octave
High Cut Filter	: 206Hz at 276 dB/Oct
Tape Format	: SEG-D 8048
Digital Filter Delay	: off
Energy Source Type	: Bolt 1500LL and 1900C
Total Capacity	: 3040 cubic inches
Number of Arrays	: 1
Number of sub-arrays	: 3
Array Length	: 14.7m
Sub Array Separation	: 10.0m
Total Number of Guns	: 26
Capacity of each Sub-Array	: 1110 in^3 starboard, 1020 in^3 inner, 910 in^3 port.
Typical Output	: 88.0 bar/metres pk-pk (at 5 metres)
Primary / bubble ratio	: 25.0 (full array, at 5 metres)
Pressure	: 2000psi +/- 10%
Depth	: 6.0 metres
Firing Delay from Time Zero	: 50ms
Shot Interval	: 25.0 metres
Number Of Groups	: 240
Group Length	: 12.5 metres
Group Interval	: 12.5 metres
Group Sensitivity	: 17.4v/ bar
Hydrophones per Group	: 16 in parallel connection (8 per 6.25m base group)
Streamer depth	: 6 metres +/- 1.0m
Typical Noise	: 1.5 to 4.0 microbars
Offset (In-line)	: 110.0m
Nav Ref.-Cent. Source	: 166.00m
Primary Navigation	: Thales Multifix 4 Version 1.3
Secondary Navigation	: Thales Multifix 4 Version 1.3
Integrated Navigation System	: SPECTRA
Echo Sounder	: Kongsberg-Simrad EA600, 12 kHz

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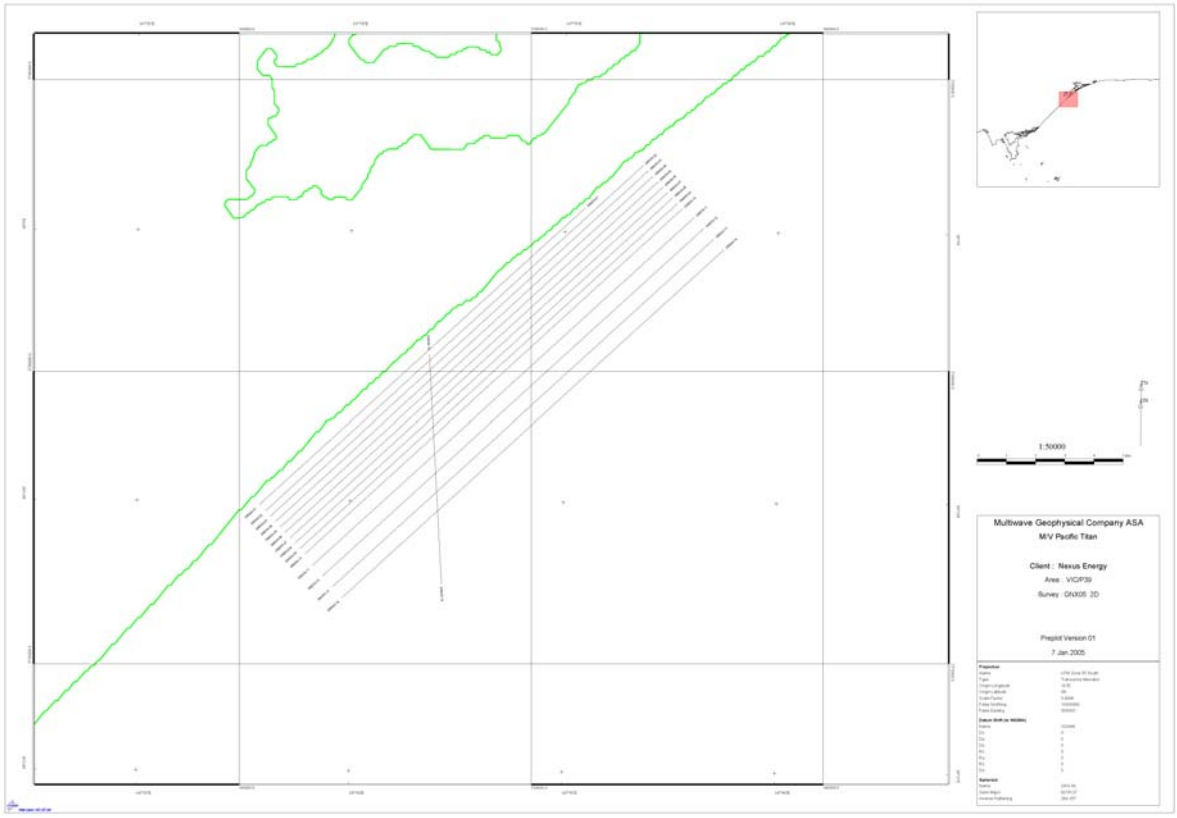
1.4 LOCATION MAP

Survey Centre: 38° 07’ 00” S 147° 35’00” E



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1.5 LINE CO-ORDINATES

LINE	NORTHING	EASTING	Calculated FF Kilometres
GNX05-01	540698	5775456	15.05859
GNX05-01	551840	5785586	
GNX05-02	540898	5775235	17.5083
GNX05-02	553827	5787041	
GNX05-03	541067	5775051	17.50763
GNX05-03	553996	5786856	
GNX05-04	541236	5774866	17.50689
GNX05-04	554164	5786671	
GNX05-05	541404	5774682	17.50763
GNX05-05	554333	5786487	
GNX05-06	541573	5774497	17.50689
GNX05-06	554501	5786302	
GNX05-07	541741	5774312	17.5083
GNX05-07	554670	5786118	
GNX05-08	541910	5774128	17.50689
GNX05-08	554838	5785933	
GNX05-09	542078	5773943	17.50763
GNX05-09	555007	5785748	
GNX05-10	542247	5773759	17.50763
GNX05-10	555176	5785564	
GNX05-11	542516	5773376	17.64703
GNX05-11	555568	5785253	
GNX05-12	542852	5773006	17.64845
GNX05-12	555905	5784884	
GNX05-13	543189	5772636	17.64771
GNX05-13	556241	5784514	
GNX05-14	543526	5772266	17.64771
GNX05-14	556578	5784144	
GNX05-15	546925	5772728	7.838782
GNX05-15	546514	5780556	
			251.0561

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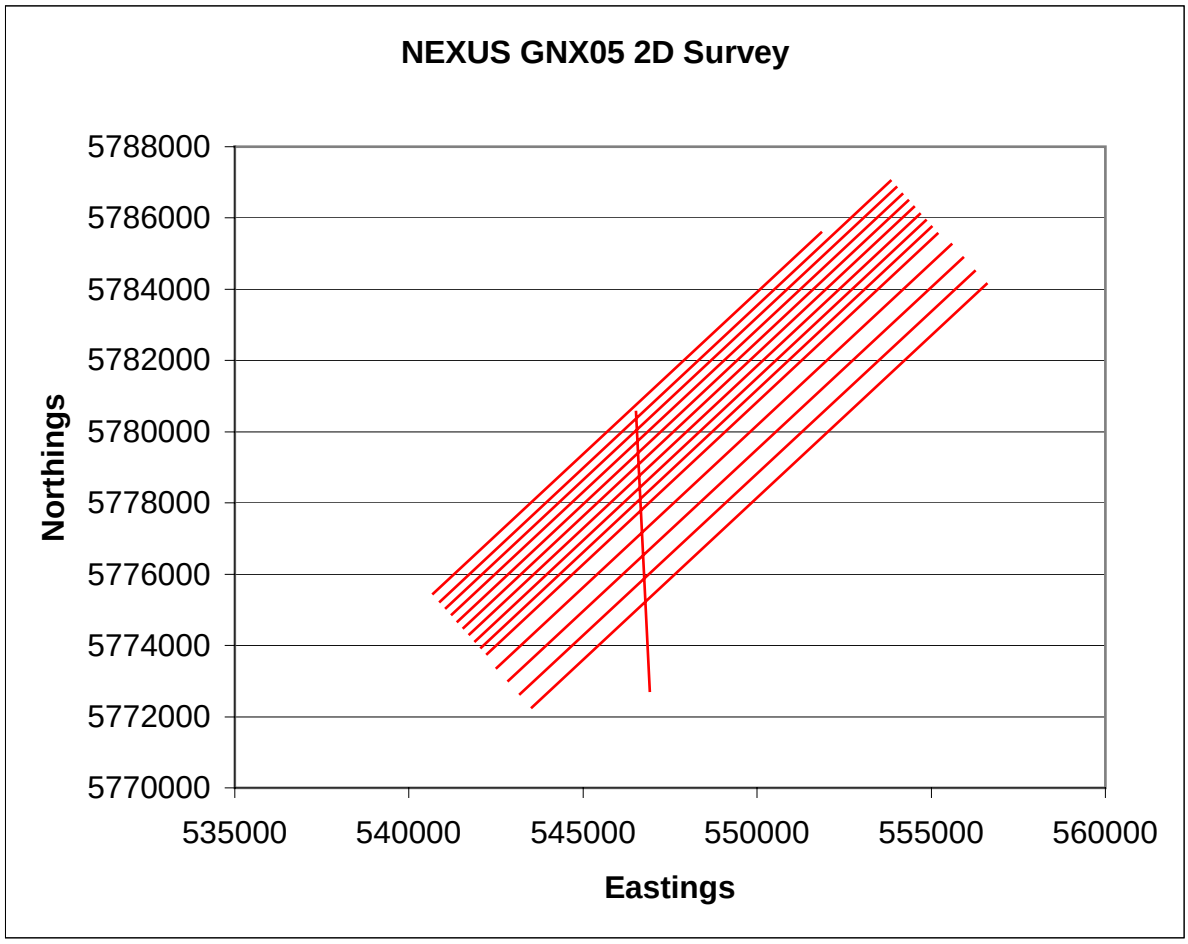
1.6 PROGRAM MAP



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2 SYNOPSIS

2.1 OVERVIEW

The survey consisted of 15 pre-plotted lines with a total of 251.0561 full fold kilometres over Permit Area VIC/P39 located in the Bass Strait Oil Fields ESE of Lakes Entrance, Victoria. A final total of 271.8 kilometres of surface coverage equivalent to 249.3 full fold kilometres were recorded. The disparity between plotted kilometres and recorded kilometres is due to line #15 being terminated to avoid the beach.

The Pacific Titan mobilised out of Hobart, Tasmania on January 31st 2005 after an extensive period in port repairing a large amount of engine room pipe work. The vessel had initially arrived in Hobart on the 21st of January 2005 the departure of the Pacific Titan was held up when the surveyor found the seawater inlet valve was illegally installed and did not meet specifications. Work continued through the 22nd to 24th. The Captain held a meeting on the Bridge at 10:30hrs of the 24th and advised the extent of the repairs would keep the Titan alongside till the 30th of January. The engineer in charge indicated that for safety reasons the work should have been carried out in a proper dry dock for safety reasons.

The vessels safety was compromised by the conditions:

- Lack of hydraulics
- Minimum electrical power available
- Emergency fire pump inadequate
- Inability to close the watertight doors because the emergency fire pump hose had to be run through the doorway.

When the vessel finally departed, it was with one of four engines inoperable and with one electrical generator working out of three. The vessel departed the dock January 31st at 15:55hrs local with a surveyor on board to adjust the magnetic compass. Once this procedure had been completed the Titan went to anchor so work could continue on repairing the second generator by pirating parts from the third generator. The anchor was lifted at 22:42hrs on January 31st and the vessel headed for VIC/P55.

Bad weather was encountered for most of the journey up the Tasmanian East coast. With only 3 of 4 engines working the vessels speed dropped to around 7.7 knots when she would normally average 10 to 11 knots.

February 09th, at the completion of the Santos VIC/P55 survey the Titan commenced recovering the source arrays to alter the array depth to 6 metres. The first 3000 metres of the streamer were also recovered while the vessel headed towards the NEXUS survey area. Transit time to the survey area was around 12 hours. On the run in to the first line seismic interference from the survey vessel Western Trident was evident on the streamer. Contact with the Trident was made; they had just started a 5-hour line. Time-sharing was discussed and the Titan turned off line to circle back to start line GNX05-05 at 22:04. A time-share loss of some 4 hours. At midnight the Titan was still recording line GXN05-07-01-001.

February 10th A good days production. At 14:15 local time contact with the Trident indicated they could not see our array and we could not see them. Time-sharing was halted and the Titan headed to line 05, sequence 005 ASAP. It was not necessary to time share for the rest of the day. The FRC was launched early afternoon to take a TS Dip, speed of sound recorded at 1520m/sec. At the end of the day line 04 sequence 007 was in production.

February 11th After processing, line 04, sequence 007 was rejected due to the interference by an air leak. Air pressure during the line had also varied dropping below normal specifications. One of two generators failed on the run in to line 12 and the Titan circled while the engineer rectified the

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problem. To allow safe recording of line 01 during daylight hours and at high tide it was necessary to break off from line 08,sequence 009 to give the Titan time to travel to the NE end of line 01. Because of shallow spots at the start of line 01,sequence 010. The Titan came on to line from the east at a slight angle also at the SW end the Titan needed to come off line to port to avoid shallow patches at the end of line. Due to the close proximity of the land, 2.4 kilometres at the west end of line 15, sequence 11 could not be acquired.
Due to personal problems (the array mechanics father had died and the observers father was gravely ill) two members of the seismic crew needed to return to their respective homes. They left the Titan, via the FRC and the chase boat Saint Andrew. The chase boat departed for Lakes Entrance at 15:00hrs and was back on station at 23:45hrs. The WesternGeco technician came onboard at this time. At midnight line 11 was in production.

February 12th The survey was completed with the acquisition of line 09, sequence 017. All source arrays were retrieved by 15:15hrs and the streamer was recovered by 16:18hrs local time. The chase boat St. Andrews was released at 16:12hrs local.

2.2 SURVEY PRODUCTION BY LINE

Seq	Line	Dir	FCSP	LCSP	KM	KMFF
001	GNX05-07-01	227	1001	1967	18.13125	16.63125
001	GNX05-07-01	227	1968	2016	0.91875	0.91875
002	GNX05-14-01	047	1001	2024	19.20000	17.70000
003	GNX05-06-01	227	1001	2016	19.05000	17.55000
004	GNX05-02-01	047	1001	2016	19.05000	17.55000
005	GNX05-05-01	227	1001	2016	19.05000	17.55000
006	GNX05-13-01	047	1001	2024	19.20000	17.70000
008	GNX05-12-01	047	1001	2024	19.20000	17.70000
009	GNX05-08-01	227	1001	1520	9.75000	9.75000
010	GNX05-01-01	227	1001	1885	16.59375	15.09375
011	GNX05-15-01	071	1001	1371	6.95625	5.45625
012	GNX05-08-02	227	1521	2016	9.30000	7.80000
013	GNX05-03-01	047	1001	2016	19.05000	17.55000
014	GNX05-11-01	227	1001	1164	3.07500	3.07500
014	GNX05-11-01	227	1165	2024	16.12500	14.62500
015	GNX05-04-02	047	1001	2016	19.05000	17.55000
016	GNX05-10-01	227	1001	2016	19.05000	17.55000
017	GNX05-09-01	047	1001	2016	19.05000	17.55000

SURVEY TOTAL

KM	KMFF
271.800	249.300

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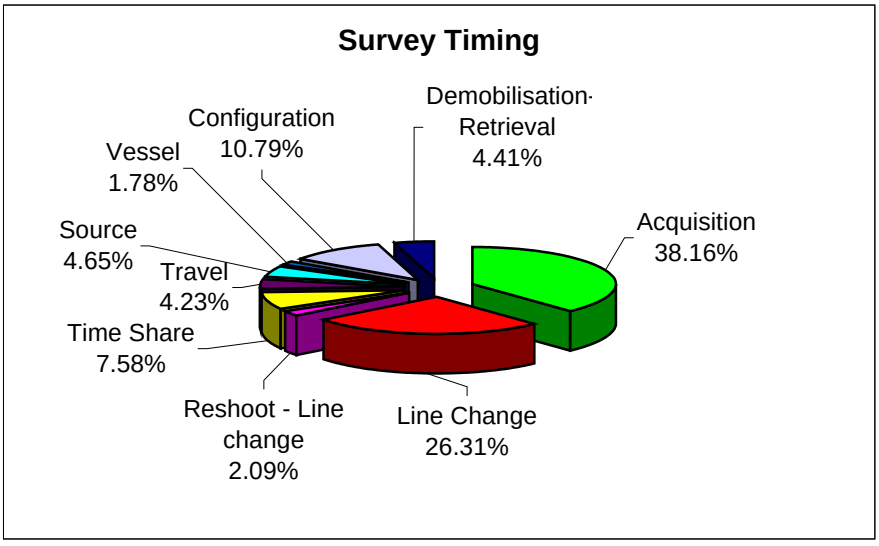
2.3 STATISTICAL SUMMARY

Total Survey Timing

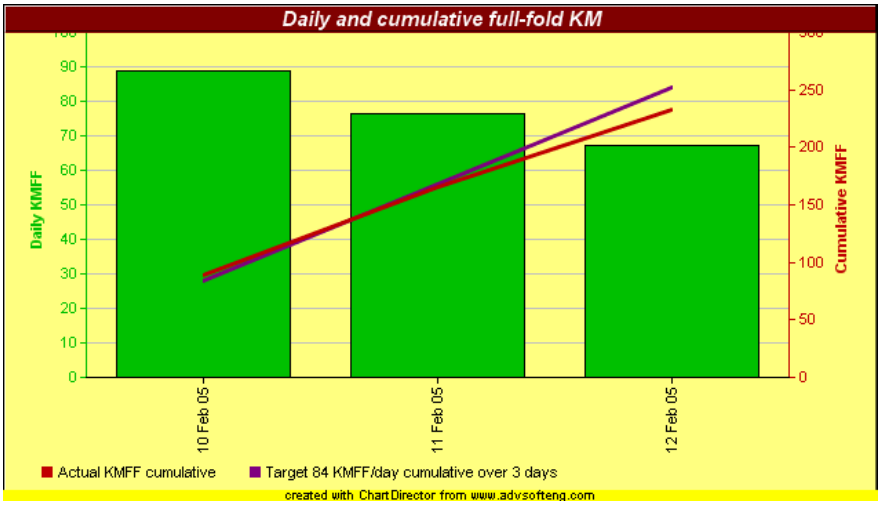
Code	Description	Duration
01	Acquisition	31.57
02	Line Change	21.77
06	Reshoot - Line change	1.73
13	Time Share	6.27
26	Travel	3.50
30	Source	3.85
36	Vessel	1.47
39	Configuration	8.93
53	Demobilisation-Retrieval	3.65

Total survey time: 82.73 hours

The following graph shows the total survey time.



Daily and Cumulative Full Fold Kilometres



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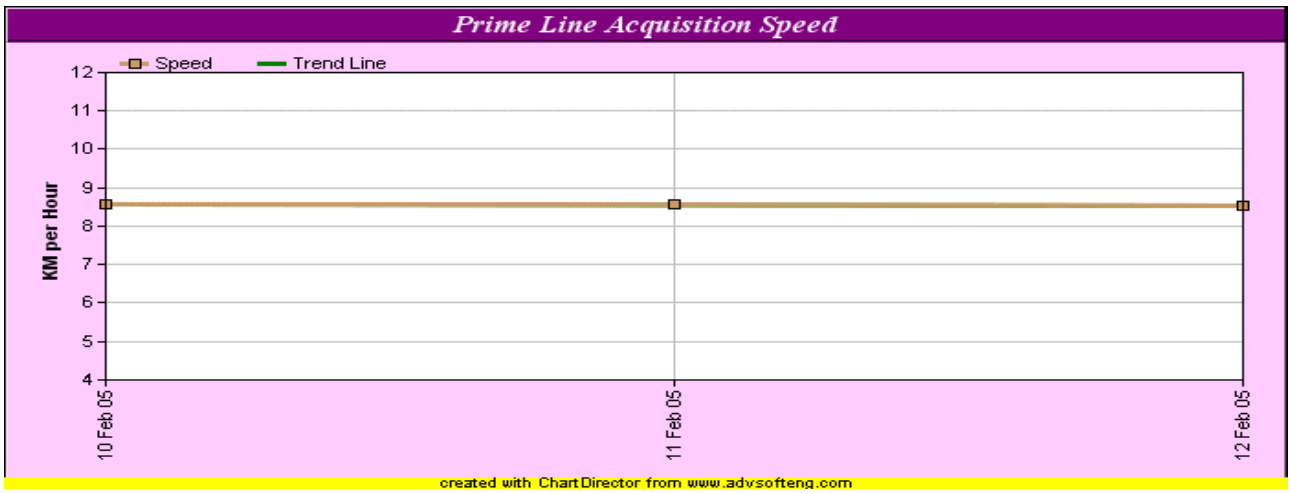
Acquisition Speed



2.4 TECHNICAL SUMMARY

The following is a brief description of individual equipment performance throughout the survey:

Recording Instruments

The Pacific Titan is fitted with a Sercel 24 bit SEAL system. This is a relatively new system for the Titan and been in service for six months. Relatively new to the market. It has been used extensively in China on land crews, proving to be robust and operator friendly. The Sercel system provided a comprehensive array of real time on screen displays, showing auxiliary channels, Streamer channel display and single trace display. The last 20 records could be accessed and displayed for QC evaluation. A shot display similar to the old oscilloscope display but greatly expanded and colour coded to indicate noise strength was also available. All displays could be manipulated to improve data QC,ing.
A full set of daily tests was automatically carried out each day showing the recording system and streamer were within contract specification. The system operated faultlessly during the survey. There was no time lost to systems failure at all.
Observer's reports were automatically generated using MGC's standard Obslog package. Faults from the recording system and array logging system were automatically generated at the completion of each line. The quality of the Observers logs was acceptable. There could have been more detail regarding streamer control and weather observations in regard to the streamer and data.

Streamer

The Sercel digital streamer worked extremely well.. Streamer depth was maintained at 7 metres. Noise levels on the data were monitored closely during QC processing.

Energy Source

Over the past few years the Pacific Titan was used primarily as a source vessel so the arrays and the attached infrastructure were in good condition. A Sealink 2000, onboard source controller and hydrophone data acquisition system was installed early 2004. A twin screen graphical interface allows for simple operator monitoring and control as well as showing deterioration of gun performance

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Gun timing could have been better but it is doubtful if the timing specifications need to be so stringent particularly for the larger source sizes over 150 in^3
A rigorous maintenance schedule was maintained on the array strings and individual elements were replaced at the specified time regardless of their performance.
The three sub arrays were equipped with a total of 26 array elements. The lay out of the spare array elements provided for easy substitutions whilst maintaining the geometry of the array by creating a mirror image of the standard layout. The drop out spec was generated by MGC. Zero time was lost to the source arrays. A 3040 cu^3 inch array was used through out the survey with only occasional low volume shots when single guns failed to operate and when substitutions were made.
The Titan has three compressors. One compressor comfortably maintained air pressure with the other two being rotated through to allow maintenance to be carried out. The 18.75m recording interval was easily with in the scope of the compressors and they performed reliably with zero time lost.

Streamer Details

Seismic data were acquired during this survey using the SEAL Digital Streamer, manufactured by Sercel, Inc.

item	description	type	amount	remark
Streamers	24 bit, digital distributed electronic	SEAL Sercel	2D, Up to 12 km active	
Depth Control	Digicourse	5011	Up to 40	
Buoyancy		Isopar M		
Retrievers	Concord	SRD	12	3 each 3 km
Streamer skin	Polyurethane	3.5mm		
Hydrophones	Vinci	NH-95-250		
Section Length	150 m			
Section diameter	50 mm			
Lead-in	300 m			
Group Length	12.5 m			
No of hydrophones per group	16			17.4V/bar sensitivity
Max number of channels	960			12.5m @ 2ms
Telemetry data link	Dual twisted pair with CRC control	AWG 22		
Power lines	Dual	AWG 14		Redundancy up to 8km
Connectors	28 pin			
Acquisition	Sercel	SEAL	1	
Format	SEG D rev.2	8058		
Recording	3590 cartridge	IBM comp.	3	
Computer	Sun	Blade 2000	1	
Bird Controller	Digicourse	System	1	
Sampling				¼, 1/2, 1,2,4 ms
Aux channels			40	max 100
Plotter	Isys	24”	1	online
Printer	HP	830 A4		Logs, tests etc.
Network	TCP/IP	100kb		Ethernet coax

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2.5 VESSEL

The Pacific Titan was built in Japan in 1982 and since that time has been through a number of transformations, from anchor handler to seismic boat, back to anchor handler before being refitted once more as a seismic vessel. A major refit in Seattle in the 90's had the vessel widened and fitted out as a multi streamer 3D vessel. Prior to this survey the Titan had completed surveys for Woodside Petroleum and a number of surveys managed by SANTOS.

Although the vessel is set up as a 3D vessel, she was a good 2D platform. The 3D capacity meant that it was possible to make use of active floats on the tailbuoy and sub arrays thus providing a higher degree of positioning accuracy than would normally be found on a 2D survey vessel. The

vessel has been poorly maintained over the years and needs to have a general tidy up to be comfortable. For the size of the vessel the cabins for both seismic and marine crews are small and cramped. On the top deck of the seismic accommodation there is a constant musty odour and dampness. Conditions are reminiscent of 20 years ago. Extended surveys on this vessel could become a serious OHS issue. There are adequate numbers of showers and toilets available and the steward worked hard to keep them clean. The showers and toilets are in a poor state and need to be completely refitted to a standard fitting the current OHS standards expected of crews and vessels on the Australian coast. The same argument could be applied to the seismic crews quarters. Swires supplied the vessel marine personnel. All seismic personnel were from various countries and contracted to Multiwave.

The instrument room while not large was well laid out with plenty of working space for all personnel. The back deck areas are split with the streamer reels above the array deck. Both areas were spacious with plenty of safe working space for both array mechanics and streamer handling. The gun deck became very wet in any thing but dead flat conditions.

The galley and mess areas were adequate. House keeping on the whole was good considering there was only one-steward, seismic cabins were left out of the cleaning cycle but the bathrooms were cleaned daily. There was also an inadequate supply of bed linen considering there was only one steward to take care of a crew of 28.

Communications are through Norsat and Inmarsat. The client has an office next to the instrument room with a network connection but no phone.

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Vessel Specifications

Name	:	M/V Pacific Titan
Owner	:	Swire Pacific Offshore Operations (Pte) Ltd
Port of Registry	:	Singapore
Date Built	:	1981
Date Refit	:	2000
IMO Number	:	8208385
Radio Call Sign	:	9V5935

Classifications

Flag	:	Singapore
Class	:	A1 (E) Seismic Research AMS ACCU
Designation	:	Seismic Research Vessel

Dimensions

Length, overall	:	64.50 meters
Beam	:	18.50 meters
Draft	:	6.00 meters
GRT	:	3211 tonnes (gross registered tonnage)
NRT	:	963 tonnes (net registered tonnage)

Machinery

Main Engines	:	4 x 1600 bhp, 6Z-ST, total 6400 bhp @ 680 rpm
Propulsion	:	2 x variable pitch, in Kort Nozzles
Bow Thruster	:	Yanmar 6LAAL-DTN, 420 bhp, 5 tonnes thrust
Generators	:	3 x 280 kW, 440v, 60 Hz alternators, driven by Yanmar 6LAAL-DTN diesel engines.

Capacities

Fuel Oil Capacity	:	1300 cubic meters
Lubricating Oil Capacity	:	5.0 cubic meters
Cable Oil Capacity	:	48.0 cubic meters
Fresh Water Capacity	:	154.0 cubic meters
Water Maker	:	2 x RO Machines, producing 20.0 cubic meters per day

Operating Capabilities

Speed	:	12 knots (Maximum), 10 knots (Cruising)
Fuel Consumption	:	9.0 cubic meters per day (average)
Endurance	:	45 days, while conducting 2D survey

Bridge Equipment

Radar	:	Kelvin Hughes Nucleus 6000A ARPA with slave in instrument room
Secondary Radar	:	JRC JMA 3210 Daylight
Echo Sounder	:	Simrad ED-162
GPS	:	Furuno GP 30
Communications	:	G.M.D.S.S. (Global Maritime Distress & Safety System)
	:	1x Skanti SSB
	:	2 x VHF
	:	2 x Inmarsat C 456304540/456304550 with
	:	Thrane and Thrane telex facility
	:	3 x VHF (portable GMDSS)
	:	2 x SART
	:	1 x EPIRB
	:	1 x Navtex

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	: 1 x Jotron TR-6102 Airband Transceiver
Satcom B	: NERA Inmarsat phone / fax : Tel: (874) 335 385 510 : Fax: (874) 335 385 513
Satcom C	: TeleNor C-Link phone / fax
High Speed data link	: TeleNor C-Link
Weather Fax	: Furuno 207

Safety Equipment

Fire monitoring and detection to all accommodation, machinery and office spaces.
Foam deluge system covering streamer winches, streamer storage reels and helideck.
Six man inflatable Man overboard boat on quick release davit.
7.5 metre, 210hp. Rigid NorSafe Fast Rescue Boat Certified for 10 people.
LSA equipment for 45 persons excluding survival suits.

Typical Breathing Apparatus

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2.6 SAFETY SUMMARY

The vessel fully adheres to the health and safety requirements as set out by SOLAS. All machinery and seismic equipment is maintained on a computerised planned maintenance system. HSE audit recommendations are implemented through the IMGC-QHSE System which highlights deficiencies identified during audits and sets target dates for the completion of work along with whom or which department is responsible. Regular cross audits are held to improve and bring to attention any problems in operations or work practises. All emergency exits and routes to exits are adequately marked. A fully integrated alarm system is in place and is tested on a regular basis. Flashing lights are fitted to alert personnel when equipment on the gun deck is either being pressurised or test fired. Fire fighting equipment is positioned at all necessary locations about the vessel. The streamer reel is covered by a foam deluge system. The streamer reels are fitted with a 'save-all'. There is no obvious drainage to the waste kerosene tank. Nearly all-lifting equipment on the gun deck consists of stainless steel chains and shackles. Lifting points on deck heads were not used unless they had been rated. All certification is current. More than adequate abandonment equipment is carried on board.

Emergency procedures are laid down and prominently displayed about the vessel. Vessel plans showing emergency escape routes along with the location of all emergency equipment are also prominently displayed. Emergency fire/boat and man-overboard drills are held on a weekly basis. Current policy, hazards, near misses and topics arising are dealt with during the HSE meetings held for all crew.
Procedures for handling trailing gear during deployment and recovery were clearly laid down and followed closely. Procedures are under constant review as both the equipment and therefore the handling techniques change. Procedures are also in place for two-boat operations, helicopter operations and at-sea personnel transfers. Safety 'toolbox' meetings were held with all personnel involved prior to any operation. A Permit to Work system was in place for all hot work (burning, welding, and cutting), confined space entry, work aloft, work on high-pressure systems and electrical systems.

Comprehensive first aid and medical supplies are carried onboard. Medical advice was on hand through the Main Norwegian SAR (+47 51 51 70 00), Rogaland Radio (MEDICO), (47 51 68 36 01) and Haukaland Hostpital (MEDICO) (47 55 97 50 00).

All seismic personnel have completed an offshore survival course, which covers survival at sea; fire fighting, first aid and helicopter underwater escape training. The Master, Chief Officer and some senior seismic personnel have undertaken advanced first aid and HSE management courses.

The waste management system in place onboard consisted of all food waste being separated prior to incineration. All glass and metal were separated for disposal ashore. Dirty oil, PVC and plastic refuse was also stored separately for disposal onshore in line with MARPOL regulations.

The standard of accommodation was adequate to poor. The general housekeeping was good.

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HSE Details for Survey

Incidents/Accidents		Exposure Hours	
Type	**Cumulative**	**Group**	**Cumulative**
Fatality	0	Client	83
Lost Time Incident	0	Maritime	1245
Medical Treatment Case	0	Seismic	914
First Aid Case	0	3rd Party	41
Restricted Work Case	0		
Material Loss or Damage	0		
Environmental Damage	0		
Near Miss	0		
Hazard	0		
Unsafe Act	0		
Total Incidents	**0**	**Total Hours**	**2283**
		Total Man Days	**95.125**

Fast Rescue Boat

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2.7 RECOMMENDATIONS & CONCLUSION

- Showers and toilets need replacing, they are in a very poor state and unhygienic
- The vessel needs two stewards not one as in the case of this survey. This is an OHS matter with regard to cleanliness of the vessel.
- The overall appearance of the vessel is poor, this reflects on both the contractor and the Company.
- With the over all OH&S performance expected of and delivered by both the Marine Crew and the Seismic Crew. The acceptance of a vessel in the Pacific Titans condition is lets down the hard work done by the crew in maintaining a safe and comfortable work environment.
- The level of seismic experience of the Bridge crew was negligible. The Captain had done one trip on Swire's other seismic vessel
- More safety drills are required.

The over all performance of the seismic crew was excellent, the level of seismic experience was above average and work was carried out in a professional manner, any problems encountered were quickly bought to the client's attention.
Safety standards by both marine and seismic crew were high, closer cooperation during drills would be an advantage and improve teamwork.

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3 NAVIGATION

3.1 NAVIGATION HARDWARE AND SOFTWARE

System	Hardware (Type and Serial No.)	Software version
Concepts Spectra	RTNμ (30/207P & 30/208P)	Spectra v 9.8.06
Concepts Reflex	Linux Workstations	Reflex v 1.9.4
SeisPos	Windows Workstation	Red Hat v 7.3
processing		v 12.30
External Header		Gcs90v2
Compass System	Digicource System 3 5011 Birds	v 5.01
TS-meter	Saiv AS STD/CTD model SD204	v 3.5.9.97
Echo Sounder	SIMRAD EA600	v 2.1.1.0
Multifix 4	Windows Workstation	v 1.03

System Timing

Spectra issued closures to the source firing system and recording system 50 milliseconds before the predicted time of peak pressure. Spectra received the time break back from the GunLink source controller and all Spectra system positions are output for this time.

An additional trigger was issued from Spectra 500 milliseconds after time zero. This was sent to the recording system as a timing verification. The trigger was 5 milliseconds in duration.

3.2 SURVEY POSITIONING METHOD USED

This survey was carried out using Multiwave's standard mode of operation for single streamer, single source surveys.

Positioning of the vessel was by Single frequency differential DGPS with delivery of differential correction data in RTCM 104 format and recorded in the P2/94 files.

The source was positioned relative to the vessel using a network consisting of rGPS units mounted on all 3 sub-arrays.

A compass heading unit and rGPS unit from the streamer head buoy positioned the centre near group of the streamer.

The centre last group of the streamer was positioned using a network consisting of one rGPS system unit mounted on the tail buoy and streamer mounted compass heading units.

The streamer shape was modelled by 11 Digicourse series 5011 combined streamer depth control and magnetic compass units on the streamer.

Least squares condition equations for the streamer assuming circular arcs between compasses and relating the tracking nodes, compasses, tension corrected distances between compasses, rotation bias and scale were used to compute scale, rotation and individual compass corrections. The streamer shape was then computed by the circular arc method.

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3.3 SURFACE POSITIONING

General

All survey and positioning work was carried out using the GRS 80 Spheroid and GDA 94 datum. Grid co-ordinates were based on the Universal Transverse Mercator projection zone 55 south. Central Meridian for zone 55 is 147°E.
Common Offshore datum shift parameters between WGS84 and GDA 94 were as specified in the contract.

For GRS 80, the following parameters were entered into Spectra INS:

Semi-Major Axis: 6378137.000 Inverse Flattening: 298.257222101

Datum Shift Parameters

For transformation of WGS84 to GDA 94

DX (m)	DY (m)	DZ (m)	Rot X (sec)	Rot Y (sec)	Rot Z (sec)	Scale (ppm)
0	0	0	0	0.000	0.000	0.000

Vessel Navigation

System 1: Fugro Multifix 4 Version 1.06
Differential correction delivery: SkyFix Spotbeam and Inmarsat B.
System 2: Fugro Multifix 4 Version 1.06
Differential correction delivery: SkyFix Spotbeam and Inmarsat B.
Differential Correction Systems:
Fugro SkyFix Standard via Inmarsat B (POR) and Spot Beam (SEAsia)

All systems had the same accuracy and were set to have the same weight in the solution.

Fugro Multifix 4 is a multiple reference station DGPS system tailored for the specific needs of seismic surveying. State-of-the art algorithms combine reference station data and pseudo range measurements into the best position estimates.

DGPS Reference Stations

By employing a correlation model for weighting the multiple range corrections in a least squares estimation process, the optimum pseudo-range corrections are obtained. W-testing and F-testing techniques detect and reject correction outliers.

Quality control is based upon UKOOA's recommended DGPS quality indicators - the precision and reliability of the fix are displayed as an Error Ellipse and Marginally Detectable Errors (MDE).

The differential corrections were transmitted to, and received on-board the vessel by two independent means and provided a high degree of redundancy to ensure continuous vessel positioning.

WGS84				
Ref. St. Name	**No.**	**Latitude**	**Longitude**	**Height (m)**
Adelaide	355	032°07' 03.054"S	133°41' 22.838"E	7.26
Melbourne	385	037°48' 29.010"S	144°57' 48.028"E	82.05
Sydney	336	033°25' 46.884"S	149° 34' 01.967"E	756.65

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Float Navigation

Float (tailbuoy, headbuoy and source) surface navigation was provided by Kongsberg-Seatex Seatrack relative GPS. The in-sea units incorporated a GPS receiver and interfacing for direct data transmission of the raw satellite pseudo-range data via UHF link to the vessel.
On board the vessel, the raw pseudo-range data from the float unit was matched with simultaneously received data at the vessel's GPS receiver to compute a vector describing the location of the float unit relative to the vessel, from which the float position was derived.

Streamer Compasses
11 series 5011 Digicourse combined magnetic compass and streamer depth controllers were attached to the streamers. All compasses were used for positioning and shaping the streamers.

Compass Sampling Rate = 2 second
Averaging constant = 14 seconds

Compass performance was monitored on a line-to-line basis throughout the acquisition phase of the survey.

Gyro Compass
The gyro compass used during the survey was:

Gyro 1 (NEMA) - Simrad HS50 GPS

The gyro correction values as computed during the mobilisation calibration were as follows:

Gyro 1 - plus 1.46 degrees

Magnetic Declination

Model: IGRF2005
Date: 2005-01-31
Position: 38°04'00.000"S 147°34'00.000"E
Magnetic Declination: 12.82ºE

Velocity of Sound in Water

CTD/CTD Velocity Profiler Model SD204 is programmed to measure data at one-metre intervals. The probe is allowed to free-fall and is then recovered. Speed of sound and depth are computed by the program, which decodes the stored information from the probe. The raw data is entered into a spreadsheet where the Medwin formula is used to calculate velocity. TS Dip calculations are set out in the appendices. **Velocity calculated at 1520.00 m/s**

ECHO SOUNDER

Primary Echosounder: Simrad Model EA600 200/12KHz

The echo sounder speed of sound was set to 1500 m/s. A draught correction of zero was entered in the echo sounder. Depth data was recorded throughout the survey using a dual transducer/dual frequency (12 KHz/ 200 KHz) Simrad EA600 Echo sounder.

Echo Sounder Verification

A verification was performed, alongside in Hobart, Tasmania. This was done using a lead line, and also depth reading from the calibrated TS probe.

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All depths recorded are based on the position of the Fathometer's transducer on the vessel's Hull. Depths are NOT draught corrected. Diagram and explanation in Appendix "A"

3.4 INTEGRATED NAVIGATION SYSTEM

The integrated navigation system used for this survey was Spectra from Concept Systems Ltd. UK. Spectra is an integrated navigation and data management system designed to handle environments of multi-vessel operations such as under shooting of obstructions as rigs. Spectra delivers data management, positioning techniques and flexibility with the following key benefits:
.

- Navigation acquisition and validation with real-time source and streamer positioning for marine seismic surveys ranging from simple 2D and high resolution requirements to extensive 3D multi-streamer, multi-vessel configurations.

- Distributed data server provides simple connectivity to easily configure multi-vessel surveys.

- Real-time data acquisition units with integrated GPS receiver provide triggering to 50 micro-seconds, allowing remote synchronization of seismic and acoustic systems.

- Real-time binning, CMP and offset distribution with simultaneous bin expansion capabilities.

- Data logging to UKOOA P1/90 and P2/94 standards with full redundancy providing confidence in data integrity.

- Quality control process providing alarm and audit facilities meeting UKOOA guidelines. Extensive online graphical analysis facilities and end of line reporting facilities.

- Positioning using Kalman Filtering with advanced data snooping statistical testing techniques.

- DGPS and RGPS real-time recomputation.

- Autopilot interface controlled from instrument room leaving the navigator in charge of steering. This facility is fully integrated with a comprehensive turn planning utility providing optimum efficiency on line changes

Multiwave's implementation of Spectra runs on work stations based on the IBM Pentium-4 PC architecture, and on the LINUX operating system.

NAVIGATION SUMMARY

The navigation system ran smoothly through out the survey. Navigation processing was efficient; files are included in the attached CD

ECHO SOUNDER

Echo Sounder data was generally good throughout the prospect. In the shallow water depths of the survey you would expect nothing less.

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4 ENVIRONMENT

4.1 WEATHER

It was possible, via the 'World Wide Web', to access data about local environmental conditions from www.weatherbuoy.com Information was reported daily with a 7 day forecast. The Australian Bureau of Metrology also has a good website with reasonably accurate forecasts for the local area. Wind direction and weather forecasts were also available from the NavTex system. Further information such as tidal movements were available the admiralty pilot for the area.

This is an area of intense weather conditions driven by strong low-pressure systems in the southern ocean. During the short period of this survey the swell was low at around 1.0 metre. The wind varied between 5 and 20 knots predominantly from the South West The weather in this area should be considered volatile and hard to accurately predict.

4.2 TIDES, CURRENT AND FEATHER

There was very little tidal influence in the area. Streamer feather angles remained well with in contract specifications for the entire survey. The pilot for the area indicated that tidal movement in the area is around 0.3 to 2.3 metres at Port Welshpool

4.3 NAVIGATION HAZARDS

The survey was conducted in relatively open waters parallel to Paradise Beach, of around 5 to 20 metres depth. The chase boat Saint Andrew preceded the Pacific Titan to monitor water depths on the shallow inshore lines. The area is a popular holiday and recreation area. Recreational fishing boats are a possible hazard

4.4 ENVIRONMENTAL

In keeping with modern survey practice environmental protection played an important role in the operating practices of Multiwave, in line with NEXUS'S own environmental concerns and the contract requirements. Survey operations were carried out under procedures designed to minimise any environmental impact at all times.

There was no off shore refuelling during the survey. The other possible area for concern was the streamer fluid. Fortunately the fluid in the streamer is very light and evaporates rapidly leaving no harmful residues. The streamer is constructed in such a way that each 12.5 metre section has a bulkhead fore and aft, restricting the possible spill to 10 -12 litres from any one section. There were no streamer fluid spills during the survey.

Great care was taken to follow International Maritime Regulations with regard to the disposal of garbage and waste. The Pacific Titan was equipped with an incinerator so that where possible most of the waste could be burnt. Ash from the incinerator was stored for proper disposal ashore. Putrescibles were discharged over the side in compliance with MARPOL regulations. Garbage that was unsuitable for burning was segregated and stored on board the vessel for proper disposal ashore. In addition the ship operates a garbage separation scheme to separate plastics, glass and metal waste. Hazardous wastes such as lithium batteries and chemicals were stored for proper disposal under the manufacturer's guidelines.

The overall environmental performance of the crew was up to modern industry standards with no garbage disposal to the sea, the main areas for improvement would be to replace the fluid filled streamer with a modern solid streamer, which contains no fluid. And the installation of an industrial standard macerator.

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4.5 CETACEAN REPORTING

The survey was carried out outside of the known whale migration period. There were no sightings of any cetaceans during the survey.

On all lines, the acoustic energy source was gradually brought up to maximum capacity over a 30-minute period (soft start) to give sufficient notice to any marine life that might have been in the area. A low volume array element was run during all line changes.

4.6 FISHING

Fishing activity was low in the area. The Pacific Titan broadcast the position and intent during the day. A navigation broadcast requesting all vessels to give the Titan a 6-mile clearance was broadcast at 6 hourly intervals.

4.7 CORAL REEFS

The vessel operated in water depths ranging from 05 to 20 metres with the streamer towed at a depth of 7 metres and the source arrays at 6 metres. No physical damage was caused to any reefs in the survey area.

4.8 CONCLUSION

The Pacific Titan and associated operations had no detrimental impact on the local environment during the seismic survey.
The only discharges into the sea were small quantities of food scraps and treated sewage waste, which fell within MARPOL guidelines.

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5 INSTRUMENT TESTS

Before the beginning of the survey a complete set of instrument tests was performed.
These tests were as follows:

- · Instrument Noise
- · Instrument Distortion
- · Instrument Crosstalk
- · Instrument Gain/Phase
- · Instrument Common Mode
- · Field Hydrophone Leakage
- · Field Capacitance
- · Field Cut Off
- · Field Noise

The start of contract tests were recorded to tape, and sent to the processing centre together with the seismic data. The result of the Start of Job Instrument tests showed all system tests well in specification and no bad seismic hydrophone groups on the streamer.

Instrument Noise Test
This test is to measure the noise of the ADC converter in the FDU. The converter's input is connected to the internal test network. A DFT is performed and the noise spectral power below 3Hz is computed. As the total energy of the output signal is known, the total noise within the bandwidth can be deduced.

Instrument Gain and Phase Test
This test is used to check for any drift of the gain and phase of the FDU's built in ADC converter within the band from DC to the filter's cut-off frequency.

The ADC supplies a pulse with known amplitude and width to the internal test network. The ADC input is connected to the internal test network. The voltage across the internal test network is measured. A DFT is computed on the DSP's output signal (for different test frequencies) and compared to a model computed with the same frequencies. The error is computed in terms of difference in amplitude and phase with respect to the model.

The test returns the maximum error computed in amplitude and phase.

Instrument Distortion Test
This test is used to check the FDU's built in ADC converter for linear response. A sine wave with known amplitude and frequency is applied to its input via the internal test network. The test returns the ratio of the spectral power of the output signal to the spectral power of all harmonics within the bandwidth determined by the selected filter.

Instrument CMRR Test
This test is used to measure the Common Mode Rejection Ratio of the FDU's built in ADC converter. A sine wave with known amplitude and frequency is applied to both of its inputs via the internal test network. The test returns the ratio of the RMS value of the output voltage, relative to the input, to the common mode voltage.

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Instrument Cross Talk Test
This test is used to measure cross talk between FDU's. The test includes two sequences:

During the first sequence, the test generator applies a sine wave to the test network in each even FDU. The ADC converter in each odd FDU measures the resulting voltage across its own test network. (The test generator in odd FDU's is disabled).

Conversely, during the second test sequence, the test sine wave is fed to each odd FDU and the resulting voltage is measured across the test network in each even FDU.

The ratio of the measured voltage to the theoretical value of the test signal is computed and displayed as Instrument Cross talk for each FDU.

Sensor Capacitance Test
This test is used to measure the capacitance of the seismic sensor connected on the channel input. The DAC supplies a sine wave with known frequency and amplitude to the channel input. The DftCorr of the output from the ADC is computed at the test frequency. Knowing the current supplied to the sensor, the total impedance can be computed.

The capacitance can finally be computed by using the imaginary part of the impedance.

Sensor Cut-off Frequency Test
With hydrophones as input sensors, measuring the cut-off frequency of the seismic channel is equivalent to determining the pulse response for the channel. The DAC supplies a pulse (with known amplitude and width) to the channel input. From the resulting voltage, measured by the ADC, the cut-off frequency of the channel is computed using a least-squares method.

Sensor Leakage Test
This test is used to measure the global leakage resistance between the seismic channel and the earth ground. During this test, the test generator creates a leak current at precisely determined points in the test network, via the FDU's earth resistance. The resulting voltage at particular points in the network is measured. As the output current of the test generator is known, the measurements allow the system to determine the leakage resistance on the positive and negative input paths of the channel. Finally the total resistance to ground can then be calculated.

End of Job Test

At the end of the survey a complete set of instrument tests was performed. These tests were as follows:

1. DCO/Noise/Range
2. Streamer RMS Noise
3. Channel Gain Accuracy
4. HD Harmonic Distortion
4. Common Mode Rejection
5. Impulse Response
6. Crosstalk Isolation Odd
7. Crosstalk Isolation Even
8. Hydrophone Response and Leakage

The result of the End of Job instrument tests verified the system. Comparing results from all the instrument tests showed that the system was stable and in specification throughout the survey.

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6 DIARY

February 9th 2005

05:34	MO	Pacific Titan recovering source array for reconfiguration while heading for the NEXUS prospect area.
06:20	MO	Pacific Titan recovering portion of the streamer for reconfiguration while heading for the NEXUS prospect area.
10:58	MO	Pacific Titan deploying source array after reconfiguration while heading for the NEXUS prospect area.
14:30	MO	Pacific Titan heading for the NEXUS prospect area.
18:00	SB	Titan standing by on time-share with Western Geco's vessel Trident.
22:04	PR	Recording line GNX05-07-01-001.

February 10th 2005

00:00	PR	Recording GNX05-07-01-001.
00:04	PR	Line change.
01:35	SB	Time share on line change.
02:12	PR	Recording line GNX05-14-01-002.
04:14	PR	Line change.
05:44	SB	Time share with Trident.
07:01	PR	Recording line GNX05-06-01-003.
09:18	PR	Line change.
10:48	SB	Time share with Trident.
11:06	PR	Recording line GNX05-02-01-004.
13:23	PR	Line change.
15:28	PR	Recording line GNX05-05-01-005.
17:54	PR	Line change.
19:33	PR	Recording line GNX05-13-01-006.
21:42	DT	Reshoot Line change line was rejected due to source array air pressure problems from BOL
23:28	DT	Recording line GNX05-04-01-007 line was rejected due to source array air pressure problems from BOL

February 11th 2005

00:00	DT	Recording line GNX05-04-01-007. line was rejected due to source array air pressure problems from BOL
01:33	PR	line change.
02:40	DT	Vessel circling on run in to line GNX05-12-01-008. Generator fault caused a shut down of the compressors.
04:08	PR	Recording line GNX05-12-01-008.
06:15	PR	Line change.
07:32	PR	Recording line GNX05-08-01-009.
08:46	PR	Line change.
11:05	PR	Recording line GNX05-01-01-010.
12:55	PR	Line change.
15:14	PR	Recording line GNX05-15-01-011.
15:59	SB	Line change back to complete line 08.
17:30	SB	Recording overlap on line 08, sequence 009.
17:43	PR	Recording line GNX05-08-02-012.
19:00	PR	Line change.
20:18	PR	Recording line GNX05-03-01-013.
22:32	PR	Line change.
23:39	PR	Recording line GNX05-11-01-014.

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February 12th 2005

00:00	PR	Recording line GNX05-11-01-014.
01:40	PR	Line change to reshoot line GNX05-04
02:50	PR	Recording line GNX05-04-02-015.
04:59	PR	Line change.
06:15	PR	Recording line GNX05-10-01-016.
08:47	PR	Line change
10:25	PR	Recording line GNX05-09-01-017.
12:39	MO	Retrieving source arrays.
15:15	MO	Recovering streamer.

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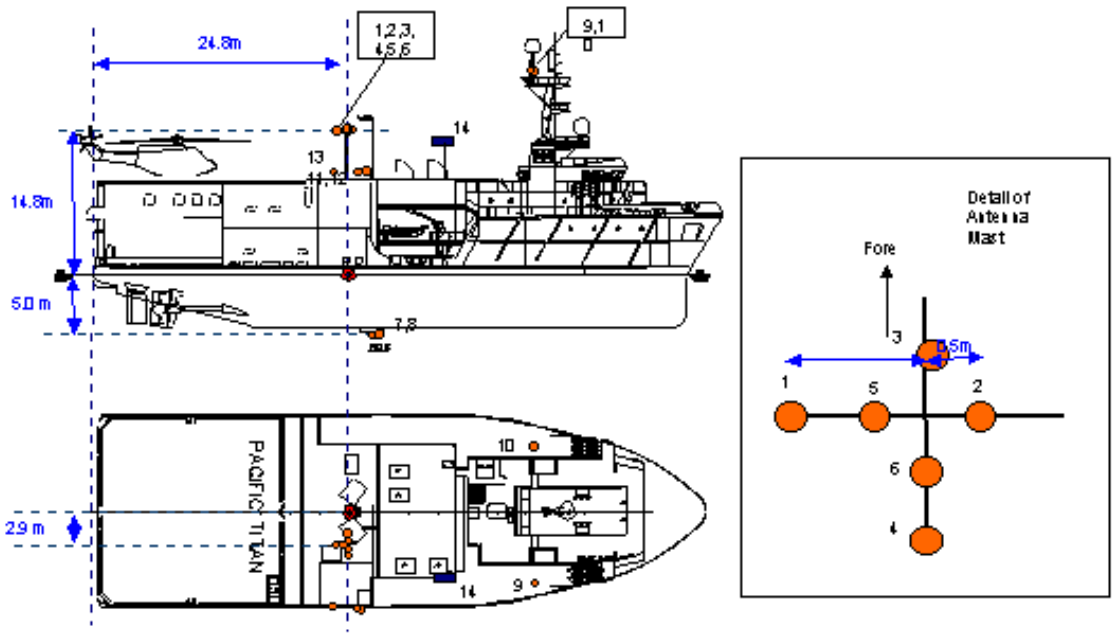
7 MEASUREMENTS

7.1 GPS ANTENNA POSITION



No.	Node/Name	X	Y	Z	Description	Cable ID
0	S1_RP	0	0	0	Vessel Reference point	
1	V1G1	2.0	0	14.8	GPS Antenna	4 Rings
2	V1G2	3.4	0	14.8	GPS Antenna	3 Rings
3					Mororolla UHF Radio Antenna	
4	Spot1				Spotfix Antenna	6 Rings
5					Yagi VCU UHF Antenna	
6					TB VCU UHF Antenna	5 Rings
7	V1E1	1.4	2.7	-5.0	Simrad EA600 12khz Transducer	
8	V1E2	-1.2	3.0	-5.0	Simrad EA600 200khz Transducer	
9	Freewave				900Mhz Antenna	
10	Speedlan				1.4Ghz Antenna	
11	Runt 1				Trimble Bullet III GPS Antenna	
12					Spare Simrad VCU UHF Antenna	No. 9
13					Sailor VHF Radio Antenna	No. 20
14	V1GY1				Simrad GPS Gyro	

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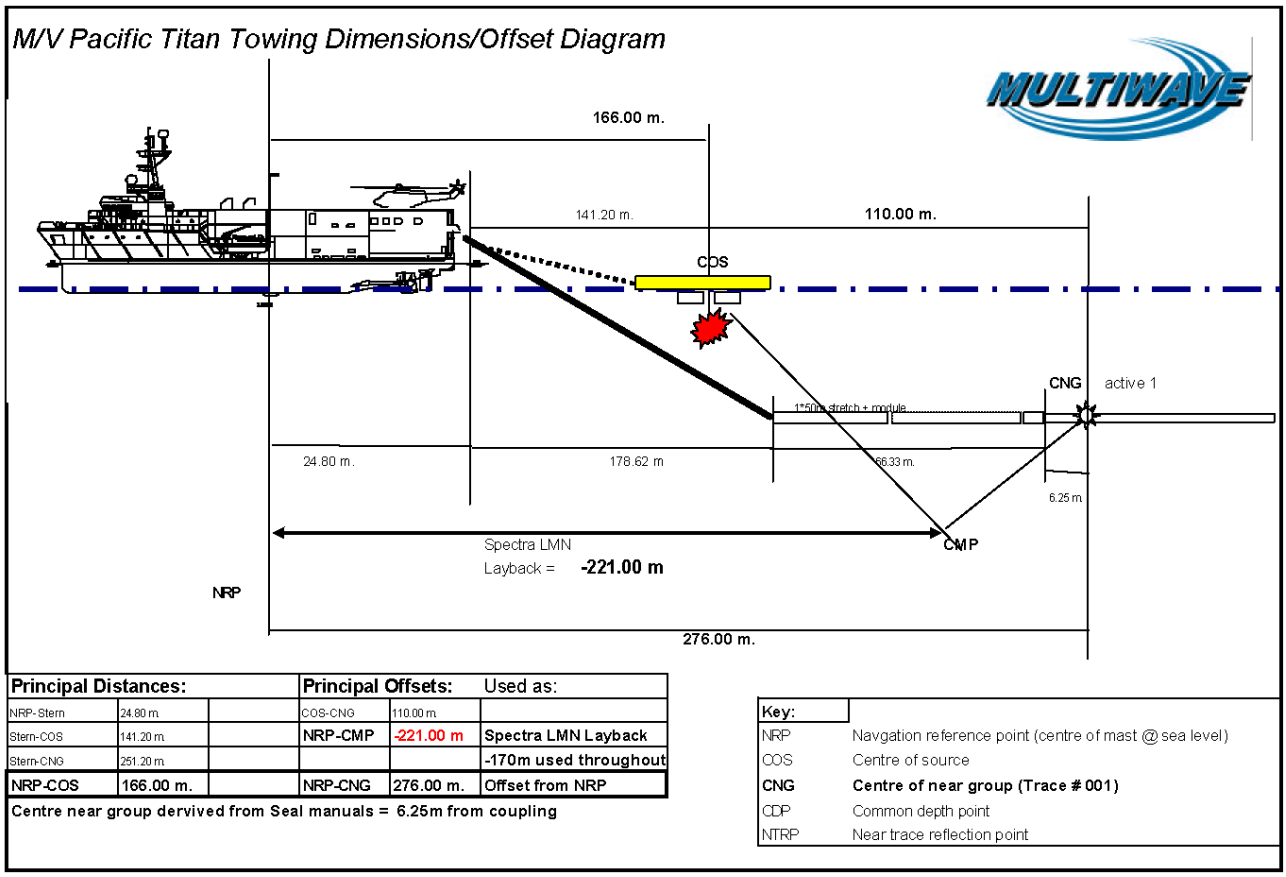
7.2 OFFSET DIAGRAM & TOWING DIMENSIONS

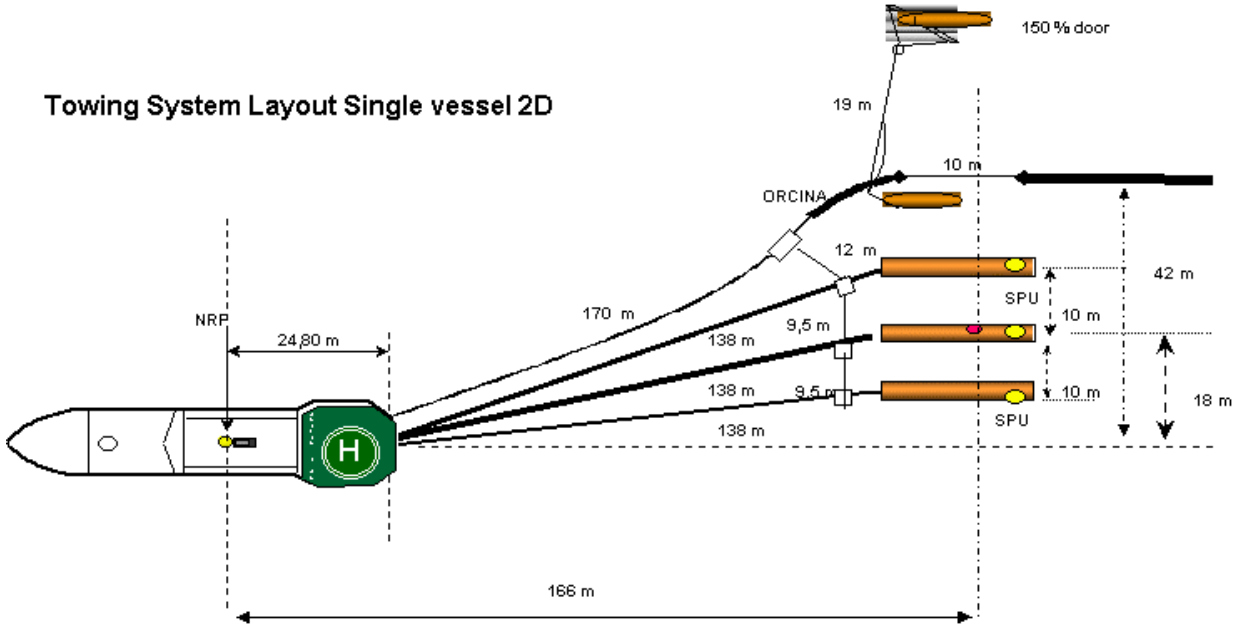


Principal Distances:			Principal Offsets:		Used as:
NRP-Stern	24.80 m.		COS-CNG	110.00 m.	
Stern-COS	141.20 m.		NRP-CMP	-221.00 m	Spectra LMN Layback
Stern-CNG	251.20 m.				-170m used throughout
NRP-COS	166.00 m.		NRP-CNG	276.00 m.	Offset from NRP

Centre near group dervived from Seal manuals = 6.25m from coupling

Key:	
NRP	Navgation reference point (centre of mast @ sea level)
COS	Centre of source
CNG	Centre of near group (Trace # 001)
CDP	Common depth point
NTRP	Near trace reflection point

7.3 TOWING SYSTEM



8 APPENDICES

8.1 MGC CONVENTIONS AND TERMINOLOGY

Glossary:

Active : 150m active streamer section (20 used in streamer)

BCU : Bird Compass Unit, Digicourse series depth / compass unit

Module : Streamer electronics module

dGPS : Differential Global Positioning System. Primary and secondary satellite navigation systems.

MOB : Man overboard boat. A fast rescue craft designed for emergencies.

SEAL 24 : Data acquisition, streamer interface and recording system

Inmarsat B : Telecom satellite communication system

DNP : Do Not Process. Data acquired but not accepted.

rGPS : Relative GPS system used for positioning source and tailbuoys

RU : Remote unit commonly known as either a bird or compass unit

SPU : Source Positioning Unit. rGPS units situated on sub-arrays

Skyfix : Fugro RTCM delivery system

Spectra : Real Time navigation system

SPECTRA : Seismic processing system

SEALINK : Digital energy source timing system

SEISPOS : Navigation QC system

8.2 LINE AND SHOT POINT NUMBER CONVENTION

Line/Job prefix: GNX05

Sail Line Format: Sail line numbers had the format GISN05-xx-yy-zzz, where:

GNX = NEXUS Petroleum identifier
05 = Year of acquisition
xx = Sail line number.
yy = attempt number.
zzz = sequence number

Shot Point numbers : Started at 1001 and incremented on all lines.

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8.3 DESCRIPTION OF LINE LOG CONTENTS

The following provides details of the data recorded for each line in the Observers Line Logs. All items appear on the individual Line Logs found on the CD accompanying this report.

Line Statistics

Seq.	: Sequence number of line (Order in which lines were shot)
Sail Line	: Client specified line number
Date	: Date on which line was started
Dir.	: Nominal line heading
Start Time	: Time of start of line, local time
End Time	: Time of end of line, local time.
SOL	: Start of line column heading
EOL	: End of line column heading
FSP	: First Shotpoint
LSP	: Last Shotpoint
KM	: Total kilometers recorded
KMFF	: Total kilometres full fold
CMP	: Na.
SQKMFF	: Na
Vessel Speed	: Vessels speed in knots at the start and end of the line.

Environment

Wind Speed	: Average wind speed in knots
Wind Dir.	: Average direction of wind
Water Depth	: Water depth below the transducer at the start and end of line
Swell	: Average swell height at the Start and End of line.
Sea State	: Sea conditions i.e. slight, moderate or rough at BOL/EOL

Streamers

SOL noise	: Ambient RMS streamer noise calculated at start of line
EOL noise	: Ambient RMS streamer noise calculated at end of line
Bad Channels	: The number of defective channels on the streamer. These can be classed as bad for several reasons, dead, noisy, spiking, leaking etc.
Feather	: The angle the streamer deviates off the line heading, negative numbers indicate port, positive numbers indicate starboard

Summary

Status	: Whether line complete or incomplete
Comments	: General summary of line quality and any particular aspect of the line which may require special attention.
Bad Records	: The number of bad shots or records on the line.

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8.4 ECHOSOUNDER CALIBRATION JANUARY 31ST

ECHOSOUNDER CALIBRATION - m/v. PACIFIC TITAN

Alongside:- **Hobart**

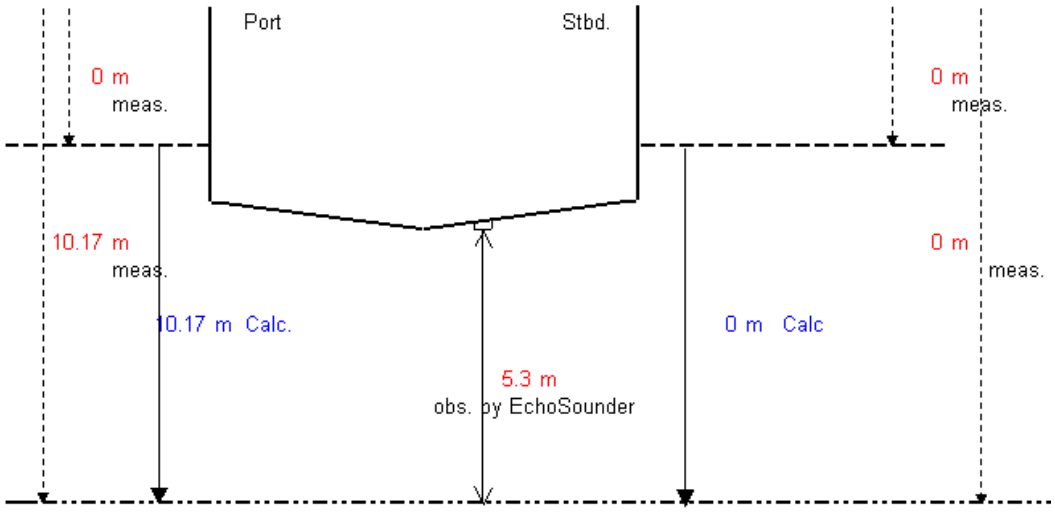
Date: **31st Jan 2005**

Time: **0:32** GMT
Taken in Port for Mobilization

Job: **6211**

Client: **SANTOS**

Measurements taken:-	metres		
Port Freeboard		EchouSounder Reading	5.3
Port TSDip	10.17	Time	8:32
Stbd Freeboard		Stbd Draught marks:	4.9
Stbd TSDip		Port Draught marks:	5



Draft Marks:

Port :	5 m		
Stbd :	4.9 m	Theoretical Draft =	4.95 m

Elecronic Depth + Theoret.Draft	10.25 m
True Measured Water depth =	10.17 m
Difference =	**0.08**

TEXT = Measured
TEXT = Calculated
TEXT = Observed

TEXT = Results

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8.5 ASSOCIATED FILES ON CD ROM

The accompanying CD-rom includes this report as well as a number of supporting documents as shown on the layout diagram below. Including the logs and analyses provided by the observers, navigators, and the ProMAX QC.

CD Folders:

1. Observer Line Logs
2. Navigators Line Logs
3. Navigation Spectra Reports
4. Navigation P1/90
5. Seismic processing Promax QC
6. Echosounder, Gyro & GPS Calibrations
7. Preplots
8. Source Specifications
9. GISN05 Report

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